MOWER HITCH FOR LAWN TRACTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a hitch for pulling powered lawn mowers behind a lawn tractor.

2. Description of the Prior Art

The prior art has long recognized the desirability of ganging together a plurality of pushed mower units, and drawing the same behind a tractor or the like. A lawn is more quickly mowed by operating several mowers simultaneously. Also, it is much easier to ride on a powered tractor than to push one or more mowers without powered assistance.

Small tractors have been developed for this purpose, as well as to draw small loads, compared to commercial farming. It would be relatively easy to connect a group of mower units which were originally intended to be individually operated in order to achieve the practical grouping described above. Accordingly, hitches for mounting to a tractor and to two or more mower units have been proposed, and several examples will be discussed.

Tow hitches for pulling two powered push mowers behind a lawn tractor are seen in U.S. Pat. Nos. 1,582,947, issued to Hayden W. Wagner et al. on May 4, 1926; 3,514,126, issued to William H. Fuss on May 26, 1970; and 4,744,580, issued to Charles C. Ryan on May 17, 1988. In the first example, a draw bar is pivotally mounted to the tractor, which in this example has an integral first power mower unit. The draw bar attaches to the frames of the two drawn mowers by, at each point of attachment, a special joint incorporating one vertical and one horizontal pivot pin. The combination of pivoting about two orthogonal axes provides universally pivotal adjustment, and will hereinafter be termed a universal joint.

The draw bar of the second example is solidly mounted to the tractor. A bracket is solidly mounted to each mower, and a link connects each bracket to the draw bar. The link loosely fits the draw bar and the respective brackets, resultant play thus accommodating maneuvering, turning, and uneven ground.

In the device of Ryan '580, the draw bar comprises a solid unitary member. Each mower is attached thereto by a short chain anchored to the draw bar at a bolt. Another similar arrangement is described in U.S. Pat. No. 3,608,284, issued to Leon P. Erdman on Sep. 28, 1971. The mowers of Erdman '284 are not self-contained, pushed, power mowers, but are specially designed to cooperate with the tow hitch.

A hitch seen in U.S. Pat. No. 3,757,500, issued to Marnie C. Averitt on Sep. 11, 1973, yokes two mowers abreast, behind a tractor. The mowers are adjustably spaced apart by telescoping members, but in other respects are solidly joined.

A ganged arrangement for drawing three push mowers behind a lawn tractor is disclosed in U.S. Pat. No. 4,815,259, issued to Wayne Scott on Mar. 28, 1989. A first hitch connects the tractor to a lead mower. Two additional mowers are connected to the lead mower by a second hitch. The first hitch is configured in a "T" shape, the stem of the T attaching to the lead mower, and the top of the T spanning and attaching to the front right and front left corners of the mower deck. The second hitch is configured generally in "U" form, the base of the U spanning and attaching to rear right and left corners of the mower deck, and the upright segments of the U connecting to the trailing mowers. The upright segments of the U terminate in tees, so as to attach to their respective mower units in the same manner as the lead mower is connected to the tractor.

U.S. Pat. No. 3,134,079, issued to Thomas J. Dunn on Jun. 2, 1964, discloses an apparatus incorporating three drawn mower units and a draft bar.

An asymmetric arrangement is seen in U.S. Pat. No. 3,832,834, issued to George E. Kovacs on Sep. 3, 1974. A draw bar attaches to two mowers, one located behind and to the side of the first. A partial frame holds the trailing mower in this orientation.

None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed.

SUMMARY OF THE INVENTION

The present invention provides an uncomplicated hitch which is substantially formed from readily available plumbing components. A major advantage of employing this class of hardware is that such components are usually prethreaded, so that connection is readily performed with minimal requirement for welding, jigs, and other aids to assembly. Also, components are available in progressively larger sizes, so that loosely interfit parts are readily available prefabricated in operable condition. This is highly useful in journaled arrangements which will be described hereinafter. With some components used in the joints, some boring or machining will be required. For example, it may be advantageous to rethread some members to include bolt thread, rather than the tapered pipe thread originally provided by the manufacturer. This will likely be required when employing schedule 80 components, which standard is of sufficient strength to be employed in the novel invention, while withstanding the loads typically encountered.

The apparatus includes a draw bar comprising a pipe having right and left telescoping extensions, there being a plate welded to the pipe for future bolting by which the draw bar mounts solidly to the tractor. The two extensions each connect to a link joining one mower to the draw bar. Connection of a link to the draw bar and this link to its mower is provided by tee couplings rotatably engaging their respective extensions and mowers.

Each link has two tees threaded thereto, one fore and one aft. The forward tee rotatably engages one of the aforementioned extensions, and the other tee similarly engages a rod mounted to the mower. The two tees associated with each respective link are arranged perpendicularly to one another, so that a universal joint is thus provided. The rear tee, which connects the link to the mower, includes stops limiting the angle between the tractor and the towed mowers to forty-five degrees to either the right or the left. This prevents excessive angles which would cause the mowers to skid on the ground, rather than rolling.

The present arrangement also provides the ability to back up, or operate in reverse, without causing the mowers to assume an inappropriate angle or to bind. For short distances, the mowers will remain aligned or oriented with the tractor so that a short reversing maneuver may be accomplished. Normal forward operation may then be resumed. No rigid connection is required to maintain control while operating in reverse.

Attachment at the mower decks is accomplished by bolting a bracket to the top surface of the mower deck. The rod mounted to the mower is so mounted by attachment to this bracket.

A third tee coupling enables this rod to pivot with respect to the mower deck, so that each mower can easily follow changing contours of the ground without scalping.

Another advantage of the present invention is that minor or incidental lateral contact with objects such as trees or fence posts is accommodated by a mower making this contact. The mower pivots around the obstacle, and mowing may proceed without stopping and disengaging the mower from the obstacle.

The combination of rotatable connections and the arrangement of stops described herein accommodates sharp turns and uneven terrain while towing mowers, while enabling the mowers to remain substantially parallel to the ground, and free from troublesome engagement of trees, posts, and the like. Thus, a mowing operation proceeds successfully in spite of obstacles requiring steering and other maneuvers.

Accordingly, it is a principal object of the invention to provide a hitch for a lawn tractor which connects to at least two power mowers.

A significant object of the invention is to design the hitch to be fabricated substantially from commonly available plumbing fittings and components.

It is another object of the invention to design the hitch to be readily assembled to and detached from associated power mowers.

It is a further object of the invention to provide a universal joint at the point of attachment to each towed power mower.

An additional object of the invention is to provide for adjustment of lateral spacing apart of towed power mowers.

It is again an object of the invention to enable tilting of an individual mower to follow ground contours without scalping.

It is a still further object of the invention to accommodate tight turns, uneven terrain, and incidental lateral contact with obstacles when towing mowers with the novel hitch.

A related object of the invention is to limit the angle between the tractor and the towed mowers to a maximum value, so that the towed mowers continue to roll across the ground, and do not skid on the ground, or otherwise disrupt successful operation.

It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective, environmental view of the invention, with certain stops omitted for clarity.

FIG. 2 is an exploded, perspective view of the invention which includes stops omitted in FIG. 1, drawn to enlarged scale.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to FIG. 1 of the drawings, the novel hitch 10 is shown attached both to a lawn tractor 2 and to two trailing powered push mowers 4. Preferably, tractor 2 is of the type incorporating a mowing unit 6, so that only two trailing mowers 4 need be attached. The ensuing swath would be equivalent to combined swaths cut by three mowers arranged abreast, and this arrangement is considered the optimal combination of widest cut and most versatile or maneuverable formation as is practical for typical large lawns. A draw bar 12 is bolted at a plate 14 welded thereto to a corresponding plate 7 of tractor 2, so that draw bar 12 is solidly mounted to tractor 2. Mowers 4 are of the self-powered, manually pushed type. Handles (not shown) normally furnished with mowers 4 are preferably removed to improve ease of towing and conformity to ground contours, but may be left in place if desired.

FIG. 2 shows the components of hitch 10. A draw bar 12 comprises a central pipe 15 welded to a bracket 16. Bracket 16 has holes 18 accepting bolts 20 (see FIG. 1) for solid mounting to a tractor 2. Draw bar 12 is arranged horizontally and normal to the longitudinal axis of tractor 2. Span of draw bar 12 is adjustable due to telescoping draw bar extensions 22. Extensions 22 are locked at any desired span distance by setscrews 24, which engage central pipe 15 at threaded holes 26. Setscrews 24 have enlarged heads or tee handles 25, so that setscrews 24 are manually tightened and slackened. Holes 26 are conveniently provided by welding a nut 28 over a hole drilled in pipe 15.

At outer ends 30, each extension 22 has a bore 32 for receiving a retaining clip 34. Clip 34 is preferably of a type which is manually installed and removed, and is resilient rather than deformable, so that it may be reused.

Two links 36 connect push mowers 4 (see FIG. 1) to draw bar 12, there being one link 36 for each mower 4. Each link 36 pivotally attaches to draw bar 12 at a first tee coupling 38A, and extends rearwardly towards its associated mower 4. Each tee coupling 38A includes a tee 40 having a stem 42 and a cross bar 44 having a throughbore 46 defined therein. A second tee coupling 38B is provided at the rearward end of link 34. Throughbores 46 of tee couplings 38A and 38B are arranged normal to one another, thus providing a universal joint.

Each tee coupling 38A is rotatable relative to its associated tee coupling 38B. This accommodates roll, in the sense that the right side of a mower becomes raised or lowered in relation to the left side of that mower. Rotation is preferably provided by threading rod 39 loosely to a tee coupling 38A or 38B, and tightly to the other tee coupling 38B or 38A. This is best accomplished by employing bolt threading at the loose connection, and employing tapered pipe threading, turned to the point of being tight, at the other connection.

Each tee coupling 38A or 38B pivotally attaches to a rod to make a necessary connection. First tee coupling 38A supports one end 30 of an extension 22. In like manner, each second tee coupling 38B engages a stem 48 of a tee 52 attached to bracket 16.

Bracket 16 includes yokes 50 retaining tee 52, arranged so that crossbar 54 of tee 52 is arranged horizontally and laterally. The stem 48 of tee 52 is rotatably held in the tee 40 of second tee coupling 38B. Stem 48

extends beyond tee 40, so that a bore 56 is accommodated to accept retaining clip 58. The third tee coupling 38C thus formed at bracket 16 enables each mower 4 to assume a fairly steep angle with respect to tractor 2. This accommodates negotiation of minor dips in terrain.

Second tee couplings 38B differ from first tee couplings 38A in that a second tee coupling 38B includes projections 60 which cooperate with a corresponding projection 62 formed in tee 52. Normally, when tractor 2 is moving straight ahead, longitudinal axes of tractor 2 and mowers 4 are parallel. However, as tractor 2 turns to the right or left, a deviation from this parallel relation, or angle formed between these axes, may be said to exist. Projections 60 and 62 will abut and interfere when this deviation or angle exceeds forty-five degrees to either side of parallel alignment of the axes. This maximum allowed angle is shown in FIG. 1. Thus, stops are provided which limit maximal deviation, so that mowers 4 will roll across the ground rather than skidding.

A stop 64 is welded in place to bracket 16 or to yokes 50 as shown, to limit the angle of inclination or tilt of a mower 4. This arrangement provides a secondary constraint controlling mower 4 while maneuvering in reverse, should projections 60 or 62 break or otherwise become inoperative.

Pipe 15, extensions 22, tees 40 and 52, and the central pipe member of link 36 are all stock plumbing components which are readily available in cooperating and appropriate sizes to accomplish the purposes of the invention. Some dimensions may require modification from the original to ensure proper fit with other components, such as boring out internal bores of tees 40. Also, threading may be recut in some instances, illustratively in cases wherein a component is modified to include pipe thread at one place and bolt threads at another. Clips 34, nut 28, and stock material for forming plate 14, brackets 16 and tee handles 25 are all commonly available materials.

Thus, it will be appreciated that the above construction and features disclose a mower hitch which is substantially fabricated from readily available plumbing components and construction materials, and which is manually assembled, disassembled, and adjusted.

It is to be understood that the present invention is not limited to the sole embodiment described above, but encompasses any and all embodiments within the scope of the following claims.

I claim:

1. A hitch for drawing a plurality of power lawn mowers behind a lawn tractor having a longitudinal axis, said hitch comprising:

a draw bar having tractor attachment means for solid attachment to the tractor, said draw bar arranged horizontally and normal to the longitudinal axis of the lawn tractor;

a plurality of brackets having mower attachment means for solid attachment to respective lawn mowers, there being one said bracket attached to each lawn mower; and

a plurality of links corresponding in number to the number of said brackets, attached to said draw bar, extending rearwardly therefrom, each said link connecting to one of the lawn mowers, each said link having a first tee coupling for attachment to said draw bar, a second tee coupling for attachment to said bracket, said first and second tee coupling of any one said link having throughbores oriented generally normal to one another, and a rod having two threaded ends, a first end of the rod having tapered threads and tightly threaded to one of said first and second tee couplings, a second end of the rod having bolt threads and loosely threaded to the other of said first and second tee couplings thus providing a universal joint, and whereby said draw bar is solidly mounted to the lawn tractor, said links universally and pivotally connect said draw bar to said brackets, and said brackets connect said links to the lawn mowers.

2. The hitch according to claim 1, each said bracket including a third tee coupling having a throughbore arranged horizontally, whereby an associated lawn mower deck may pivot horizontally with respect to said third tee.

3. The hitch according to claim 1, further including means for manually adjusting and locking the span of said draw bar.

4. The hitch according to claim 1, one of said first and second tee couplings having a vertical axis of rotation, there further being stops incorporated therein limiting pivot thereof to a maximal deviation of forty-five degrees from the tractor longitudinal axis.

5. The hitch according to claim 1, further including manually installed and removed fasteners for maintaining said links attached to said draw bar and to said brackets.

6. The hitch according to claim 1, each one of said brackets including a stop limiting tilt of an associated lawn mower.

7. A hitch for drawing a plurality of power lawn mowers behind a lawn tractor, said hitch comprising:

a draw bar having tractor attachment means for solid attachment to the tractor, said draw bar arranged horizontally and normal to the longitudinal axis of the lawn tractor, and including means for adjusting and locking the span of the draw bar;

a plurality of brackets having mower attachment means for solid attachment to respective lawn mowers; and

a plurality of links corresponding in number to the number of said brackets, attached to said draw bar, extending rearwardly therefrom, each said link connecting to one of the lawn mowers, each said link having a first tee coupling for attachment to said draw bar, and a second tee coupling for attachment to said bracket, said first and second tee couplings of any one said link having throughbores oriented normal to one another, thus providing a universal joint, each of said second tee couplings having a vertical axis of rotation and having a notch forming two downwardly extending projections, there further being manually installed and removed fasteners for maintaining said links attached to said draw bar and to said brackets,

each said bracket including a third tee coupling having a throughbore arranged horizontally and a vertical stem having a corresponding projection extending normal to said vertical axis cooperating with said downwardly extending projection thereby limiting pivot thereof to a maximal deviation of forty-five degrees from the tractor longitudinal axis, each one of said brackets including a second stop limiting tilt of an associated lawn mower, whereby said draw bar is solidly mounted to the lawn tractor, said links universally and pivotally connect said draw bar to said brackets, and said brackets connect said links to the lawn mowers.

* * * * *

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United States Patent [19]

Umemoto et al.

[11] Patent Number: 5,481,857

[45] Date of Patent: Jan. 9, 1996

[54] MOWER BLADE MOUNTING STRUCTURE

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[22] Filed: Apr. 4, 1994

[30] Foreign Application Priority Data

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Sep. 7, 1993 [JP] Japan 5-221627
Sep. 30, 1993 [JP] Japan 5-244038

[51] Int. Cl.[6] A01D 34/66; A01D 34/82; A01D 67/00

[52] U.S. Cl. 56/12.6; 56/14.7; 56/15.8; 56/320.2

[58] Field of Search 56/12.6, 14.7, 56/13.5, 15.8, 17.5, 320.1, 320.2

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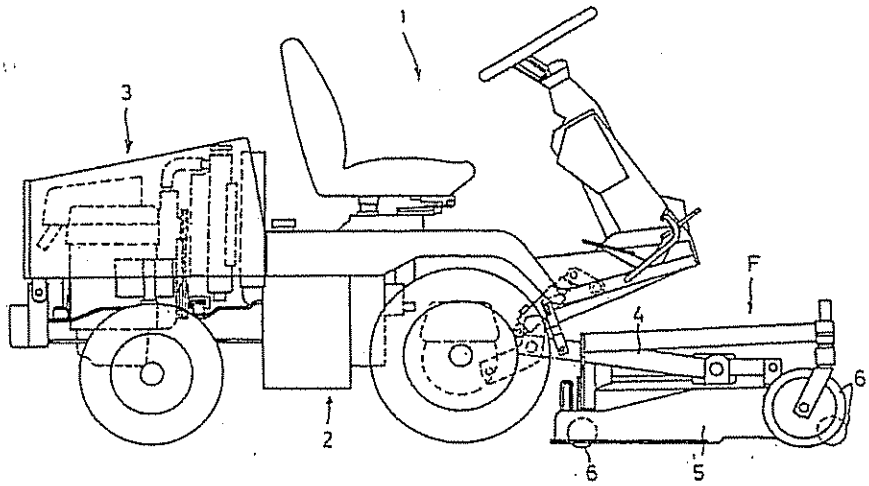
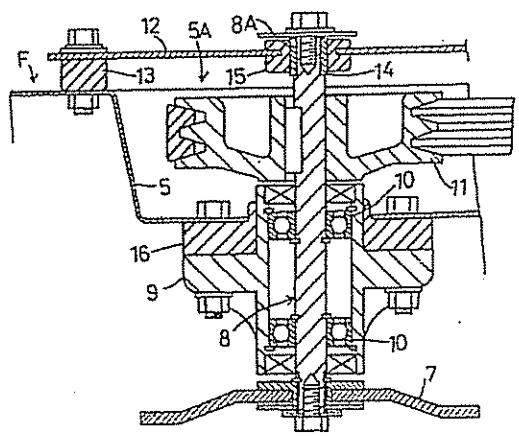
Primary Examiner—George A. Suchfield
Attorney, Agent, or Firm—Jordan and Hamburg

[57] ABSTRACT

A mower unit includes a plurality of blade mechanisms each having a blade and a blade shaft fixed to the blade for supporting the blade, pulleys and a belt for transmitting drive among the blade mechanisms, a plate-like support frame for interconnecting the blade mechanisms through intermediate members, a mower deck, and vibration proofing rubber elements disposed between the mower deck and the blade mechanisms.

19 Claims, 13 Drawing Sheets





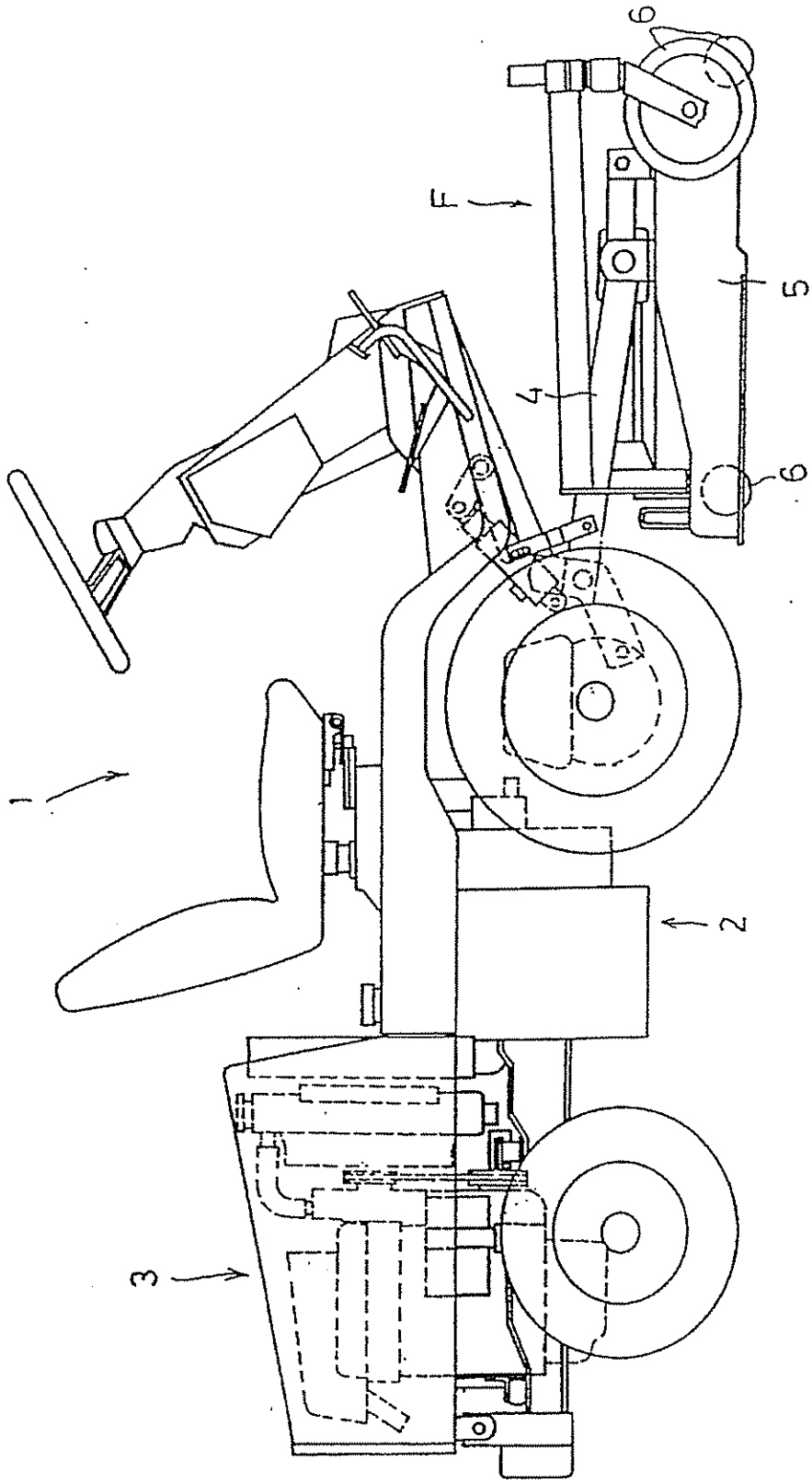


Fig. 1

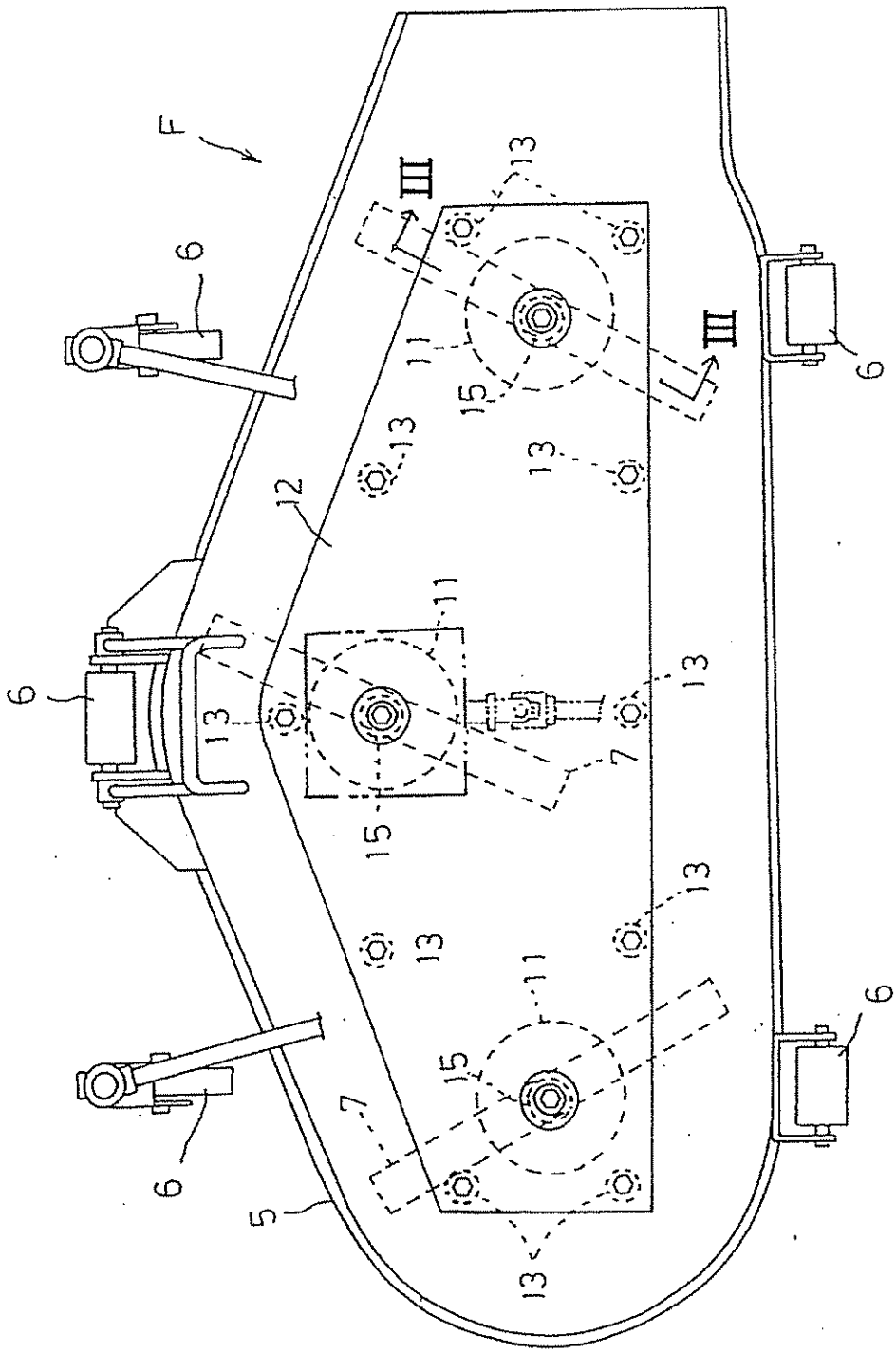


Fig. 2

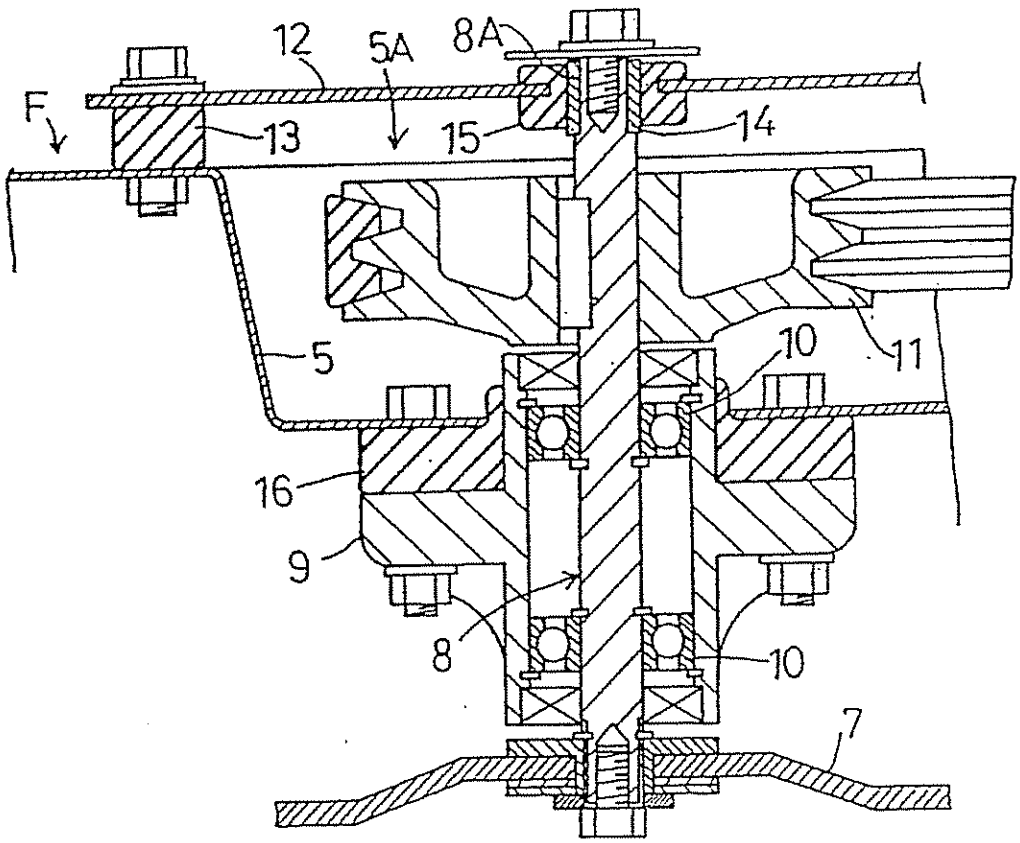


Fig. 3

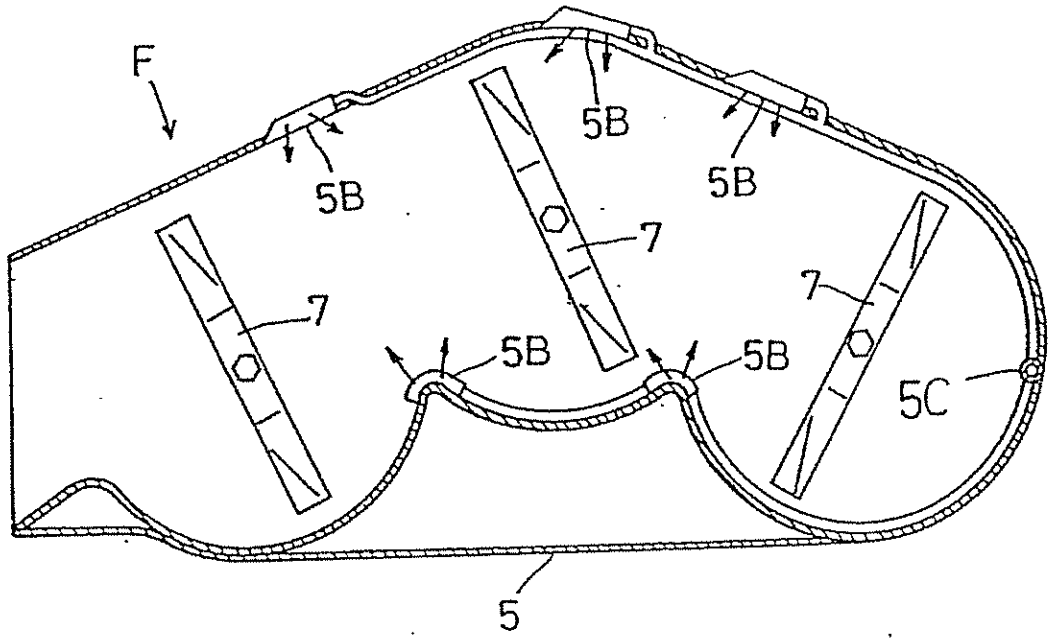


Fig. 4

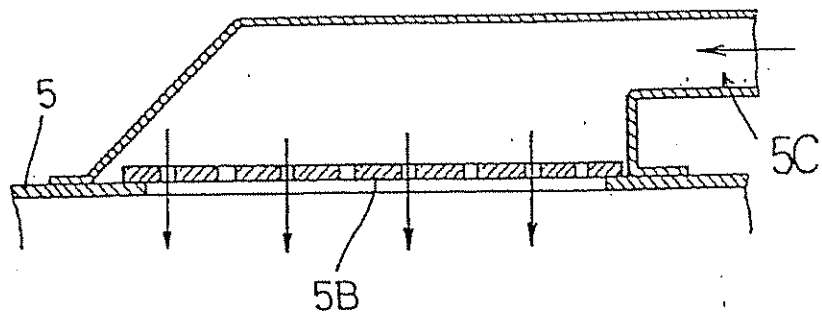


Fig. 5

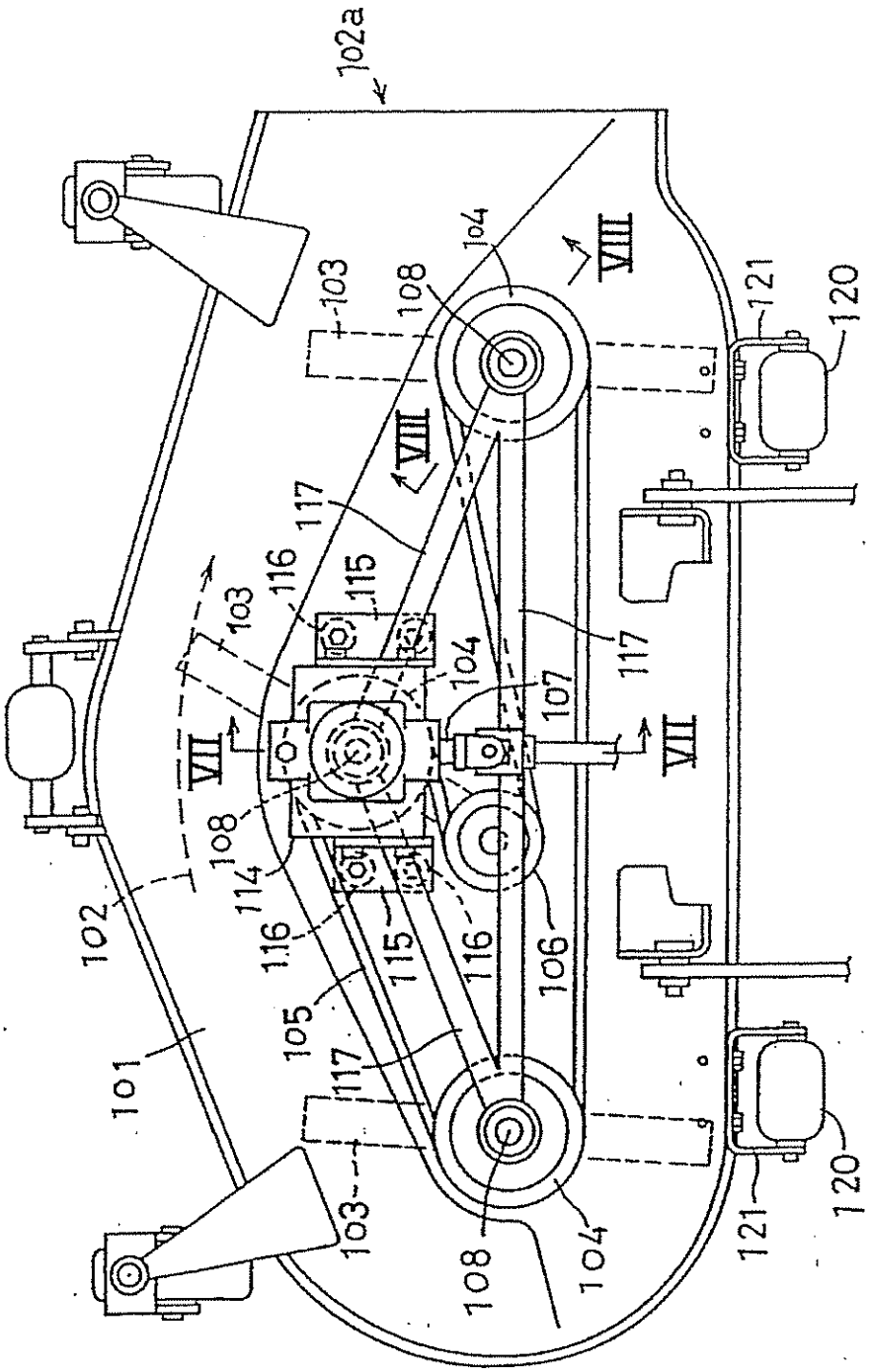

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Fig. 6

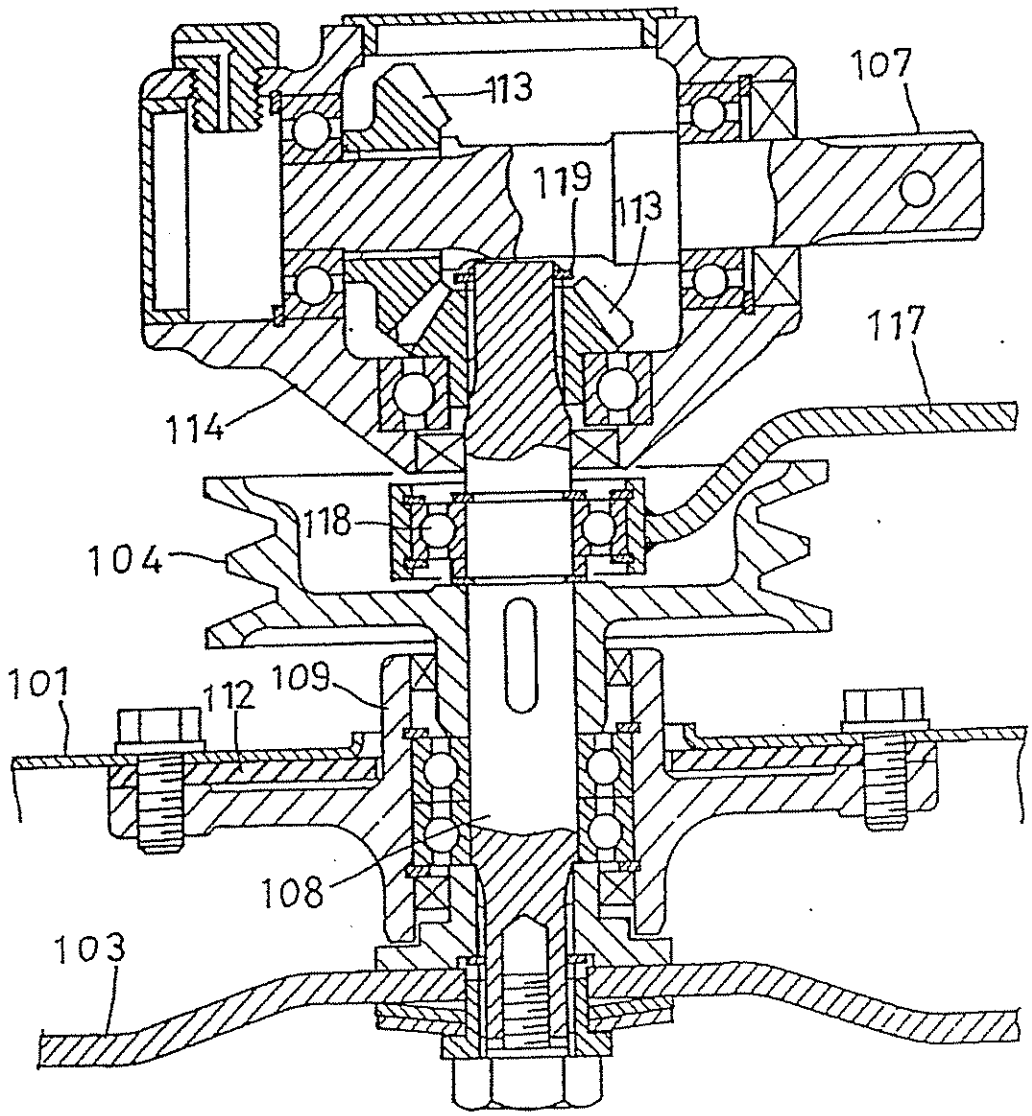

Fig. 7

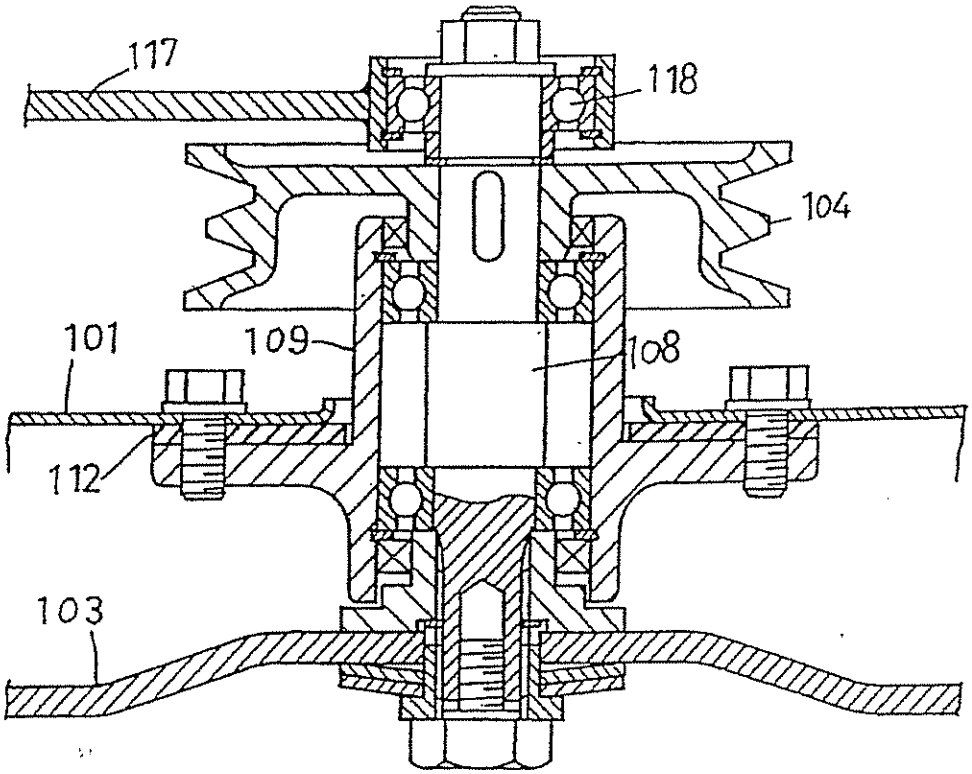
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Fig. 8

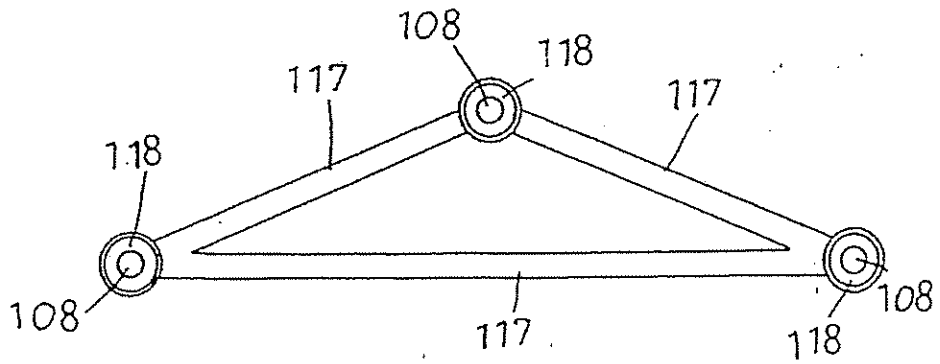
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Fig. 9

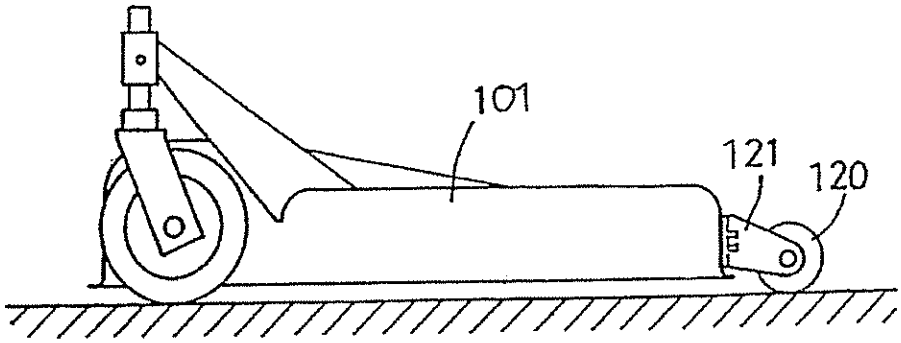

Fig.10

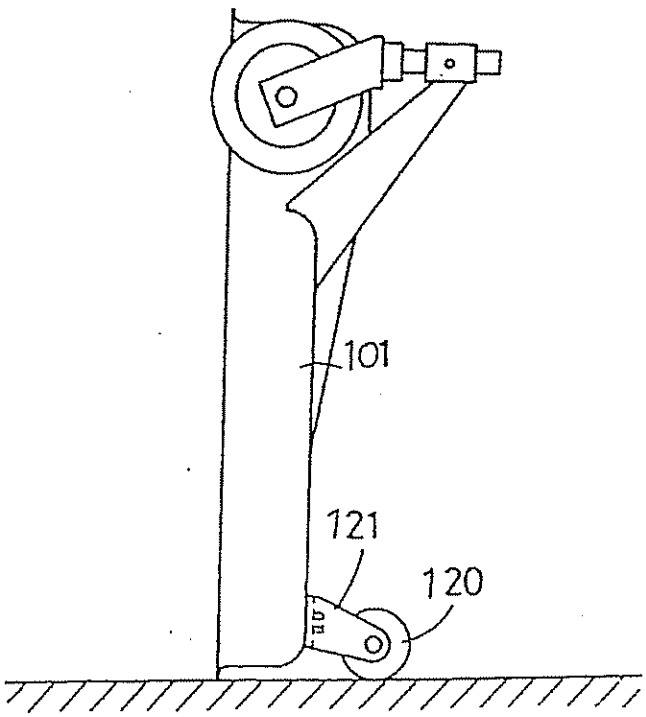

Fig.11

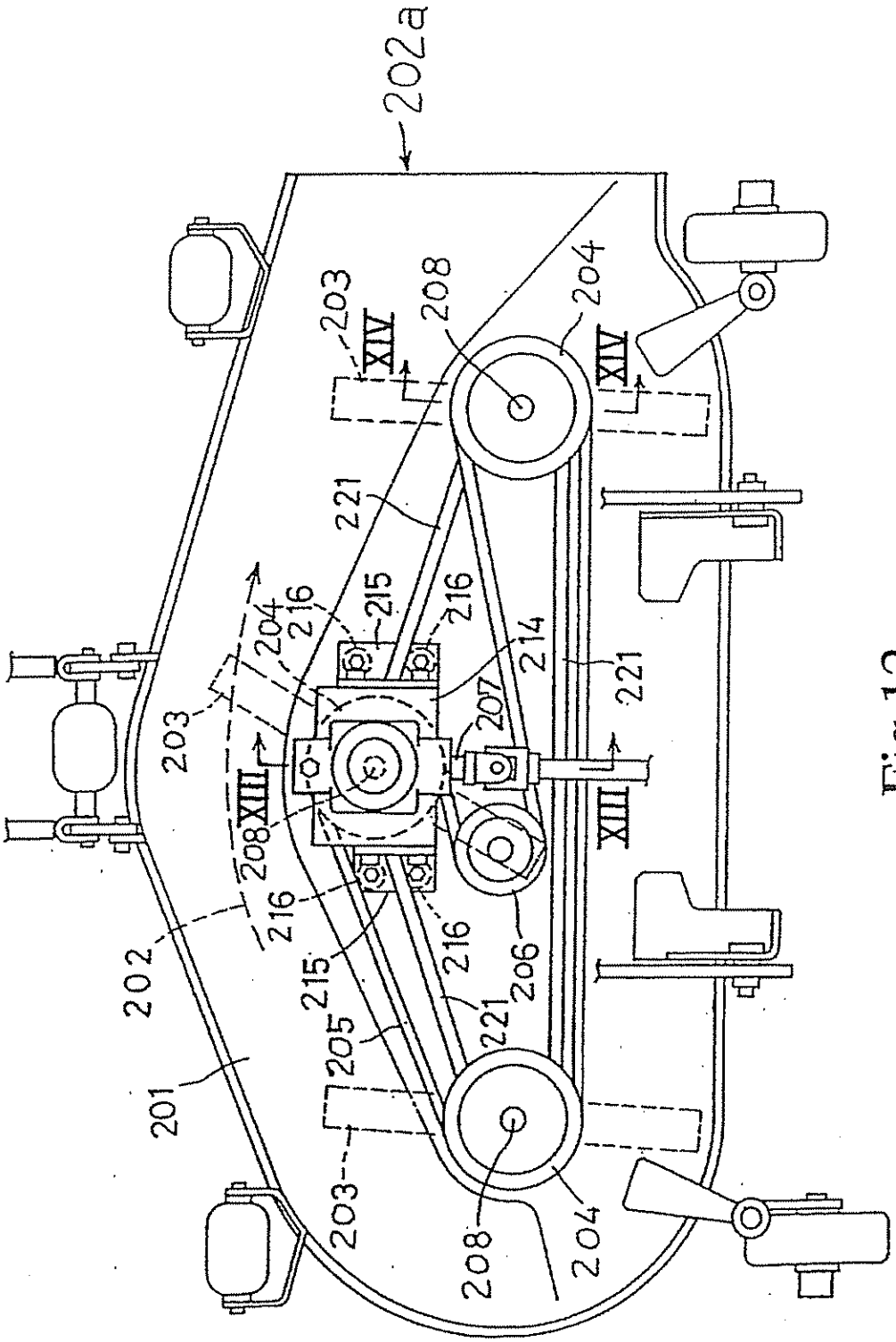
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Fig.12

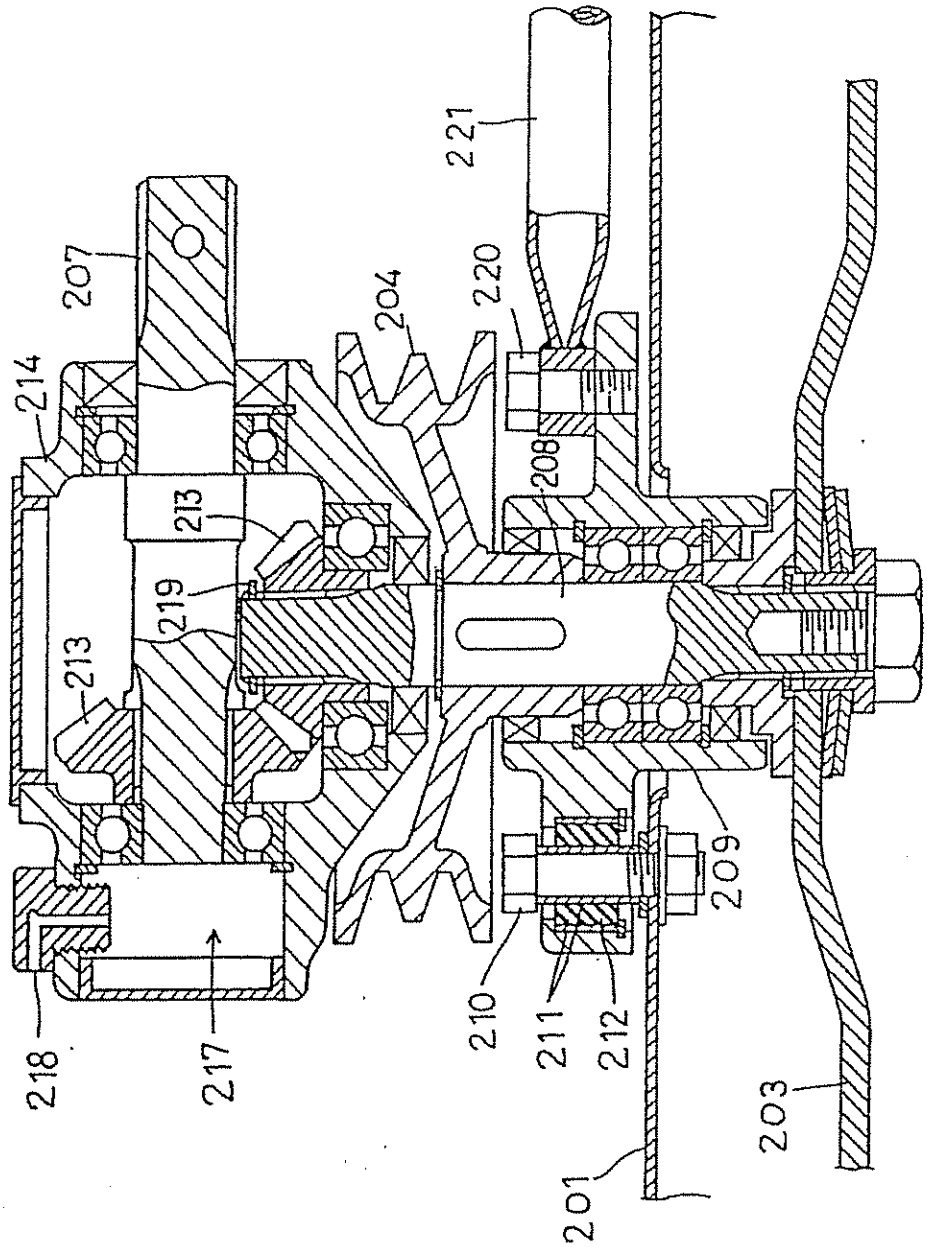
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Fig.13

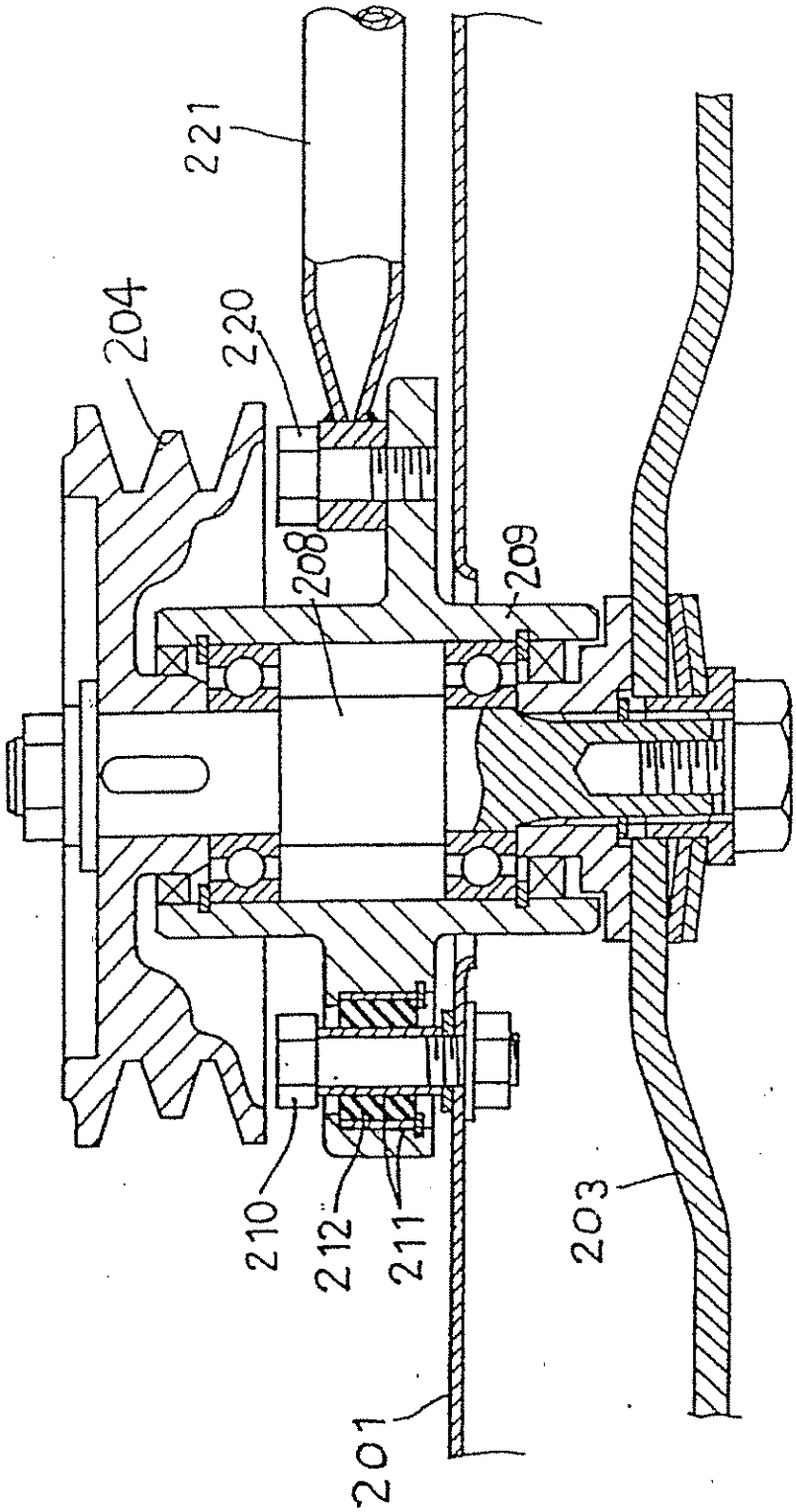

Fig. 14

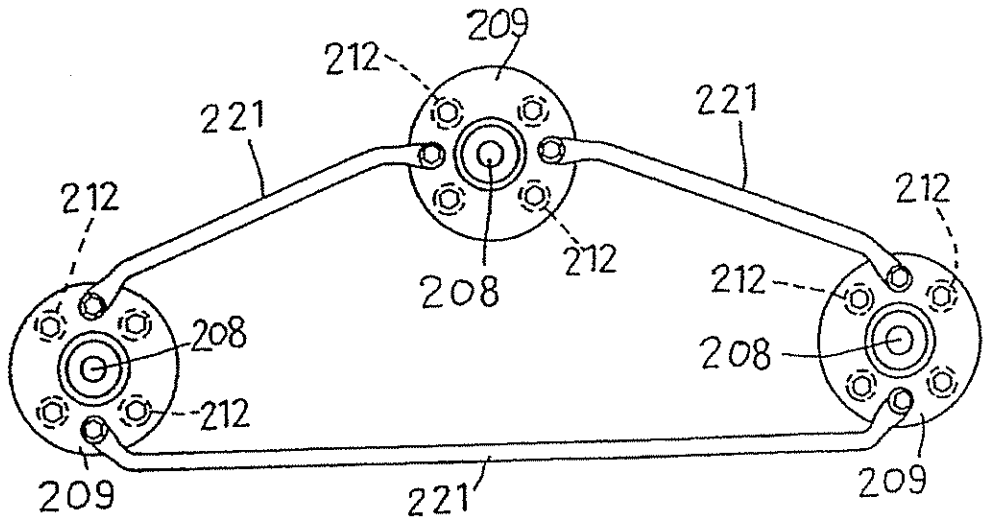
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Fig.15

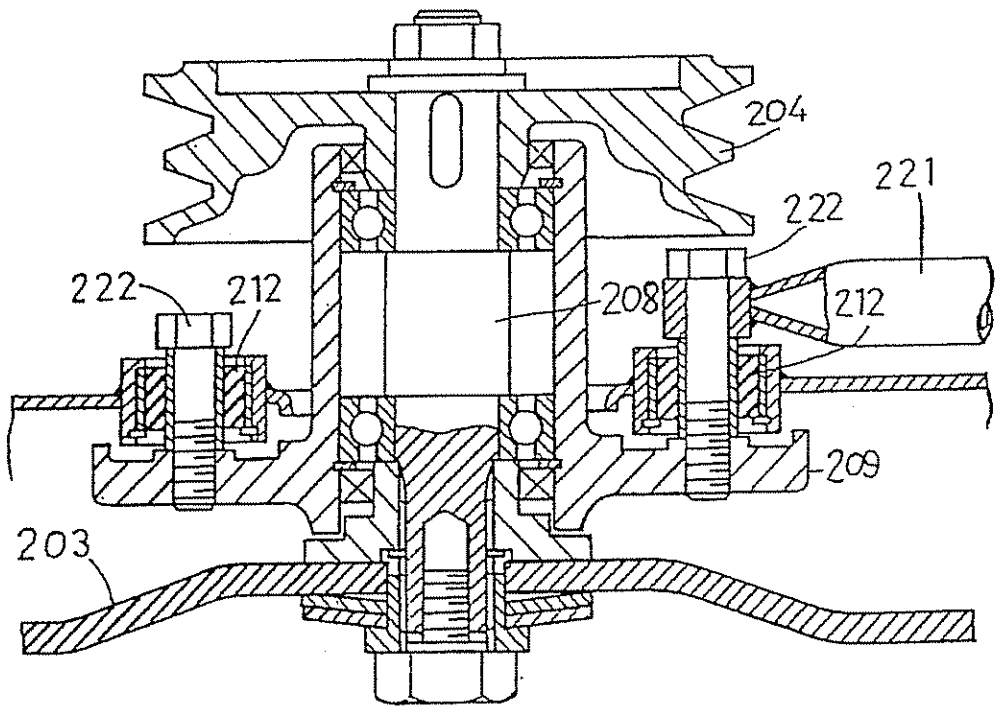
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Fig.16

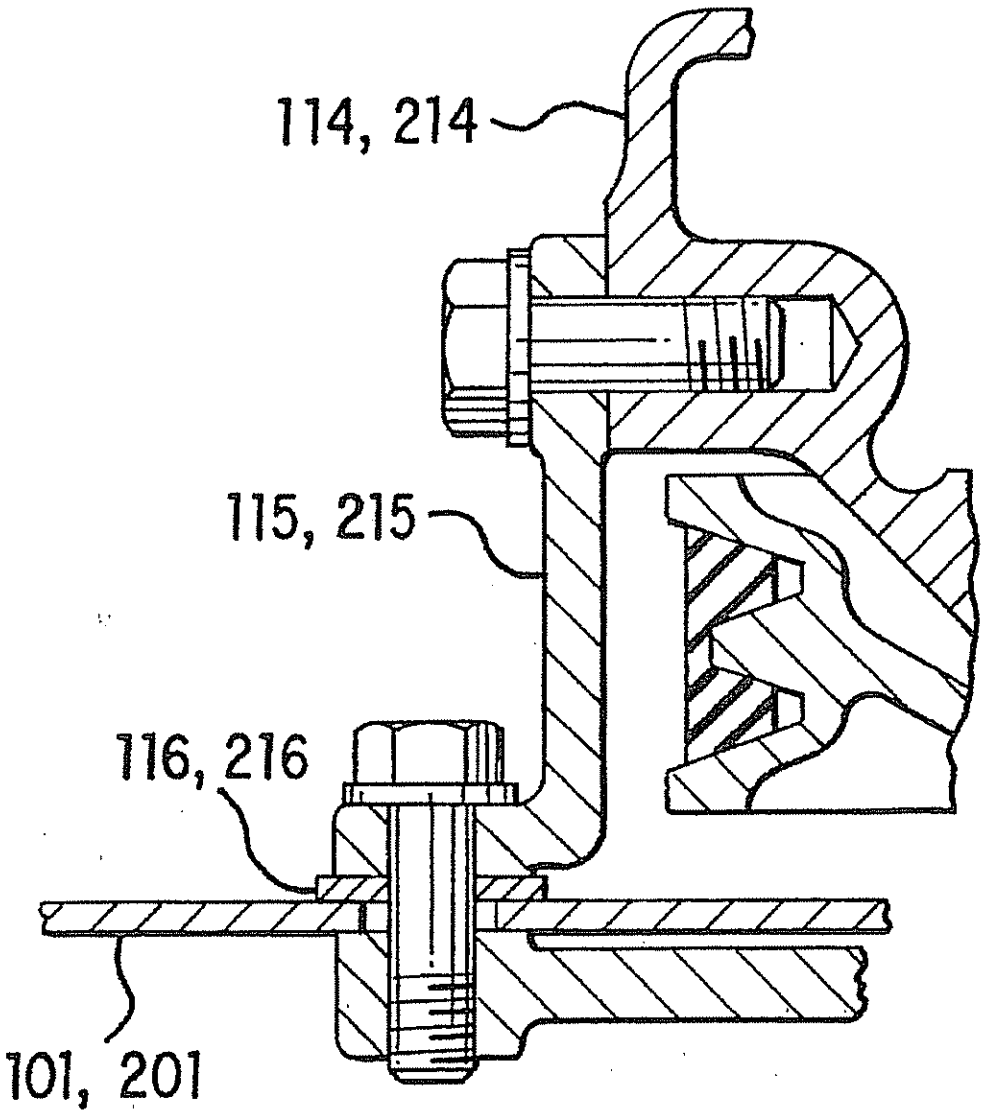

FIG. 17

MOWER BLADE MOUNTING STRUCTURE

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates a mower blade mounting structure for attaching a plurality of blade shafts having grass cutting blades and pulleys to a mower deck, with a transmission belt wound around the pulleys.

2. DESCRIPTION OF THE RELATED ART

A conventional mower unit includes blades supported by support shafts, and blade shafts fixed to the support shafts and having bearings fixed to a mower deck. However, the mower deck tends to resonate with vibrations of a mower drive system to produce loud noise. Thus, this construction has room for improvement from the viewpoint of quietness.

SUMMARY OF THE INVENTION

An object of the present invention is to effectively suppress vibration of a mower deck due to a mower drive system to diminish noise to a satisfactory level without entailing faulty blade drive.

The above object is fulfilled, according to the present invention, by a mower unit comprising a plurality of blade mechanisms each having a blade and a blade shaft fixed to said blade for supporting said blade, drive transmitting means for transmitting drive among said blade mechanisms, rigid connecting means for interconnecting said blade mechanisms through intermediate members, a mower deck, and vibration proofing means disposed between said mower deck and said blade mechanisms.

According to the above construction, vibration proofing elastic elements are disposed between the blade shafts and mower deck. These elastic elements effectively suppress resonance of the mower deck with vibration of a mower driving system, to diminish noise produced by the mower deck.

Where the vibration proofing elastic elements are simply placed between the blade shafts and mower deck, the blade shafts could be displaced relative to one another due to deformation of the elastic elements. Then, a transmission belt wound around a plurality of pulleys could slip to cause faulty blade drive. In a preferred embodiment of the present invention, the plurality of blade shafts are rigidly interconnected through a rigid connecting member to maintain the blade shafts at fixed distances relative to one another. This construction is effective to avoid the faulty blade drive due to slippage of the transmission belt.

Thus, the present invention provides a mower unit which effectively suppresses noise of the mower deck due to vibration of a mower drive system to realize improved quietness while assuring reliable blade drive by a transmission belt.

Further and other objects, features and effects of the invention will become more apparent from the following more detailed description of the embodiments of the invention taken with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a lawn tractor including a mower unit having a blade mounting structure according to the present invention;

FIG. 2 is a plan view of the mower unit;

FIG. 3 is a section taken on line III—III of FIG. 2 showing a blade mounting structure in a first embodiment of the invention:

FIG. 4 is a sectional view showing interior of a mower deck:

FIG. 5 is a sectional plan view of a mechanism for preventing grass clippings from adhering to the mower deck;

FIG. 6 is a view of an important portion of the mower unit showing a blade mounting structure in a second embodiment of the invention;

FIG. 7 is a section taken on line VII—VII of FIG. 6;

FIG. 8 is a section taken on line VIII—VIII of FIG. 6;

FIG. 9 is a front view of a support frame acting as rigid connecting means;

FIG. 10 is a side view of the mower unit in an operative position;

FIG. 11 is a side view of the mower unit in a position for storage;

FIG. 12 is a view of an important portion of the mower unit showing a blade mounting structure in a third embodiment of the invention;

FIG. 13 is a section taken on line XIII—XIII of FIG. 12;

FIG. 14 is a section taken on line XIV—XIV of FIG. 12;

FIG. 15 is a front view of a support frame acting as rigid connecting means;

FIG. 16 is a section taken on line D—D' of FIG. 12 showing a blade mounting structure in a further embodiment of the invention; and

FIG. 17 is a fragmentary section view depicting the manner of attaching a drive components incasing structure to the mover deck.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A first embodiment of the present invention will be described hereinafter with reference to the drawings.

As shown in FIG. 1, a riding lawn tractor includes a driver's section 1 disposed in a front portion thereof, a propelling drive transmitting section 2 disposed in an intermediate to rearward portion, and a motor section 3 disposed in a rear portion. A front mower unit F is connected forwardly of the tractor.

The front mower unit F includes a mower deck 5 connected through lift links 4 to a vehicle body. The mower deck 5 has ground wheels 6 arranged in front and rear and right and left positions, so that the front mower unit F is movable on the ground. As shown in FIG. 2, three blades 7 are arranged substantially transversely in an interior space of the mower deck 5.

A blade support structure will be described in relation to one of the blades 7. As shown in FIG. 3, a supporting boss 9 is attached to a predetermined position in a downwardly opening recess 5A of the mower deck 5 through a rubber element 16 acting as a vibration proofing member. A vertical blade shaft 8 is rotatably supported in the supporting boss 9 through bearings 10. The blade 7 is fixed to a lower end of the blade shaft 8. A belt winding pulley 11 is fixed to an upper position of the blade shaft 8 projecting from the supporting boss 9. The pulley 11 and a belt for rotating the pulley 11 constitute a drive transmitting device.

Such supporting bosses 9 are disposed in a plurality of positions in the downwardly opening recess 5A. Pulleys 11 are attached to the blade shafts 8 supported by the supporting

bosses 9, respectively. A transmission case 12 is attached to the mower deck 5 through vibration proofing rubber elements 13 to cover regions above the pulleys 11. Each blade shaft 8 extends upward through the pulley 11 and transmission case 12. The following mechanism is provided between an upper extension 8A of the blade shaft 8 and the transmission case 12. A bush 14 is fitted on the extension 8A. The bush 14 has a baked outer peripheral surface to which a vibration proofing rubber element 15 is attached. This rubber element 15 is attached also to the transmission case 12. This structure provides a vibration proofing support for the supporting boss 9 and avoids tilting of the blade shaft 8. This structure also closes a gap between the mower deck 5 and transmission case 12, and a gap between the blade shaft 8 and transmission case 12, to prevent entry of grass clippings and the like.

As shown in FIGS. 4 and 5, the mower deck 5 includes inner walls 5B formed of perforated metal and applied to portions of an outer peripheral wall. Passages are formed between the inner walls 5B and outer wall to jet out compressed air or water through the inner walls 5B to scatter grass clippings or the like adhering to portions of the mower unit. Reference 5C in the drawings denotes an inlet of the air or the like. The vibration proofing elements for supporting the transmission case 12 may be disposed either between the transmission case 12 and blade shafts 8 or between the transmission case 12 and mower deck 5. This type of mower unit is applicable to a walking operator type lawn mower as well as a riding lawn tractor.

A second embodiment of the present invention will be described with reference to FIGS. 6 through 11.

As shown in FIG. 6, a downwardly opening mower deck 101 has three grass cutting blades 103 arranged along a grass discharge passage 102. The blades 103 are attached to lower ends of three blade shafts 108 having pulleys 104 attached to upper positions thereof, respectively. A transmission belt 105 is wound around the three pulleys 104, with a tension pulley 106 acting on the transmission belt 105. The middle blade 103 is interlocked to an input shaft 107 to which drive is transmitted from a PTO shaft of a tractor, for example. Thus, the blades 103 are rotatable to cut grass and discharge grass clippings outwardly of the mower deck 101 through an outlet 102*a* at one end of the grass discharge passage 102.

As shown in FIG. 7, the blade shaft 108 supporting the middle blade 103 has a bearing bracket 109 attached to the mower deck 101 through a vibration proofing rubber element 112. This suppresses noise due to resonance of the mower deck 101 with vibration of a mower drive system.

The input shaft 107 and blade shaft 108 are interlocked through bevel gears 113 mounted in a case 114. The case 114 is attached to the mower deck 101 through brackets 115 and vibration proofing rubber elements 116 in manner as shown in FIG. 17. One of the bevel gears 113 is attached to the blade shaft 108, with a gap provided between the bevel gear 113 and a retainer clip 119, to allow vertical relative movement between the blade shaft 108 and bevel gear 113. This gap accommodates vertical relative movement between the blade shaft 108 and bevel gear 113 due to the vibration proofing rubber elements 112 and 116.

As shown in FIG. 8, the blade shaft 108 supporting the right or left blade 103 has a bearing bracket 109 attached to the mower deck 101 through a vibration proofing rubber element 112. This suppresses noise due to resonance of the mower deck 101 with vibration of the mower drive system.

As shown in FIGS. 7 through 9, the three blade shafts 108 are interconnected through a rigid connecting frame 117, with a bearing 118 mounted between each blade shaft 108 and rigid connecting frame 117. In FIG. 9, for example, the rigid frame 117 is shown having an isosceles triangle configuration. Thus, the three blade shafts 108 have fixed distances among themselves, while avoiding faulty drive of the blades 103 due to slippage of the transmission belt 105 despite deformation of the vibration proofing rubber elements 112.

As shown in FIGS. 10 and 11, the mower deck 101 includes a pair of right and left free rotation rollers 120 attached to rear positions thereof to override obstacles on the ground with ease. The rollers 120 are switchable between a use position and a contained position by reversing or turning roller supporting stays 121. Thus, the mower deck 101 detached from the tractor may be stored in a narrow space as standing steadily with support provided by the free rotation rollers 120.

A third embodiment of the present invention will be described with reference to FIGS. 12 through 16.

As shown in FIG. 12, a downwardly opening mower deck 201 has three grass cutting blades 203 arranged along a grass discharge passage 202. The blades 203 are attached to lower ends of three blade shafts 208 having pulleys 204 attached to upper positions thereof, respectively. A transmission belt 205 is wound around the three pulleys 204, with a tension pulley 206 acting on the transmission belt 205. The middle blade 203 is interlocked to an input shaft 207 to which drive is transmitted from a PTO shaft of a tractor, for example. Thus, the blades 203 are rotatable to cut grass and discharge grass clippings outwardly of the mower deck 201 through an outlet 202*a* at one end of the grass discharge passage 202.

As shown in FIG. 13, the blade shaft 208 supporting the middle blade 203 has a beating bracket 209 connected through a vibration proofing rubber element 212 to a bolt 210 secured to the mower deck 201. The rubber element 212 is attached by baking between inner and outer metal collars 211. This suppresses noise due to resonance of the mower deck 201 with vibration of a mower drive system.

The input shaft 207 and blade shaft 208 am interlocked through bevel gears 213 mounted in a case 214. The case 214 is attached to the mower deck 201 through brackets 215 and vibration proofing rubber elements 216, this mounting arrangement being seen, e.g., in FIG 17. The case 214 has a lower portion lying in a recess defined in the pulley 204, so that the case 214 has a reduced height. This case 214 is the oil bath type defining an air/oil separating chamber 217 having a breather 218 attached to an upper position thereof. One of the bevel gears 21 3 is attached to the blade shaft 208, with a. gap provided between the bevel gear 213 and a retainer clip 219, to allow vertical relative movement between the blade shaft 208 and bevel gear 213. This gap accommodates vertical relative movement between the blade shaft 208 and bevel gear 213 due to vibration proofing rubber elements 212 and 216.

As shown in FIG. 14, the blade shaft 208 supporting the right or left blade 203 has a bearing bracket 209 connected through a vibration proofing rubber element 212 to a bolt 210 secured to the mower deck 201. The rubber element 212 is attached by baking between inner and outer metal collars 211. This suppresses noise due to resonance of the mower deck 201 with vibration of the mower drive system.

As shown in FIG. 15, the three bearing brackets 209 are interconnected through three rods 221 securely attached thereto by bolts 220. Thus, the three blade shafts 208 have fixed distances among themselves, while avoiding faulty drive of the blades 203 due to slippage of the transmission

belt 205 despite deformation of the vibration proofing rubber elements 212. These rods 221 have sufficient strength to act as a frame though the rods are in the form of hollow pipes and are lightweight.

While this embodiment includes three blades 203, the number of blades is optional. Further, as seen from FIG. 16, a vibration proofing rubber element 212 may be mounted between the mower deck 201 and each bolt 222 secured to the bearing bracket 209.

What is claimed is:

1. A mower unit comprising:

a plurality of blade mechanisms each having a blade and a blade shaft fixed to said blade for supporting said blade;

drive transmitting means for transmitting drive among said blade mechanisms;

rigid connecting means for interconnecting said blade mechanisms through intermediate members;

a mower deck mounting and housing said blade mechanisms; and

vibration proofing means disposed between said mower deck and said blade mechanisms; and

said intermediate members being bearings.

2. A mower unit as defined in claim 1, wherein said vibration proofing means comprises elastic elements.

3. A mower unit as defined in claim 2, wherein said elastic elements are formed of robber.

4. A mower unit as defined in claim 1, wherein said drive transmitting means includes pulleys mounted on said blade mechanisms, respectively, and a transmission belt interconnecting said pulleys.

5. A mower unit as defined in claim 4, wherein said connecting means essentially comprises a plate member covering upper surfaces of said pulleys.

6. A mower unit as defined in claim 1, whercin one of said blade mechanisms includes a bevel gear mechanism for receiving drive from a drive source of said mower unit, said bevel gear mechanism including bevel gears attached to said blade shaft and to an input shaft extending substantially perpendicular to said blade shaft.

7. A mower unit as defined in claim 5, wherein said rubber is substantially plate-shaped.

8. A mower unit as defined in claim 3, wherein said rubber is substantially ring-shaped.

9. A mower unit as defined in claim 1, wherein said mower deck is attached to said blade shafts through said vibration proofing means and bearings and at a location between said drive transmitting means and said blades.

10. A mower unit as defined in claim 9, wherein said connecting means is disposed above said drive transmitting means.

11. A mower unit as defined in claim 9, wherein said connecting means is disposed between said drive transmitting means and said mower deck.

12. A mower unit comprising:

a plurality of blade mechanisms each having a blade and a blade shaft fixed to said blade for supporting said blade;

drive transmitting means for transmitting drive among said blade mechanisms;

rigid connecting means for interconnecting said blade mechanisms through intermediate members;

a mower deck mounting and housing said blade mechanisms; and

vibration proofing means disposed between said mower deck and said blade mechanisms; and

said intermediate members being vibration proofing elastic elements.

13. A mower unit comprising:

a plurality of blade mechanisms each having a blade and a blade shaft fixed to said blade for supporting said blade;

drive transmitting means for transmitting drive among said blade mechanisms;

rigid connecting means for interconnecting said blade mechanisms through intermediate members;

a mower deck mounting and housing said blade mechanisms; and

vibration proofing means disposed between said mower deck and said blade mechanisms, said connecting means including metal rods for maintaining said blade mechanisms at substantially fixed distances relative to one another.

14. A mower unit as defined in claim 13, wherein said rods are are arranged to present a plan profile of an isosceles triangle, and connected to said blade shafts through bearings.

15. A mower unit comprising: a plurality of blade mechanisms each having a blade and a blade shaft fixed to said blade for supporting said blade;

drive transmitting means for transmitting drive among said blade mechanisms;

a mower deck mounting and housing said blade mechanism;

rigid connecting means for interconnecting said blade mechanisms and substantially covering an upper surface of said drive transmitting means and supporting said blade mechanisms said rigid connecting means maintaining said blade mechanisms at substantially fixed distances relative to one another; and

first vibration proofing means disposed in at least one of a position between said connecting means and said blade shafts and a position between said connecting means and said mower deck, and second vibration proofing means between said mower deck and said blade mechanisms.

16. A mower unit as defined in claim 15, wherein said vibration proofing means comprises elastic elements.

17. A mower unit as defined in claim 16, wherein said elastic elements are formed of rubber.

18. A mower unit as defined in claim 15, wherein said drive transmitting means includes pulleys mounted on said blade mechanisms, respectively, and a transmission belt interconnecting said pulleys.

19. A mower unit as defined in claim 15, wherein said mower deck is attached to said blade shafts through said vibration proofing means and bearings and in a position below said drive transmitting means.

* * * * *

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United States Patent [19]

Lonn

[11] Patent Number: 5,497,604

[45] Date of Patent: Mar. 12, 1996

[54] SUPERVISOR SWITCH FOR TURF MOWER

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[73] Assignee: The Toro Company, Minneapolis, Minn.

[21] Appl. No.: 191,796

[22] Filed: Feb. 3, 1994

[51] Int. Cl.[6] A01D 34/60

[52] U.S. Cl. ..... 56/10.2 H; 56/7; 56/11.9

[58] Field of Search ..... 56/10.2 H, 6, 7, 56/11.1, 11.3, 11.9

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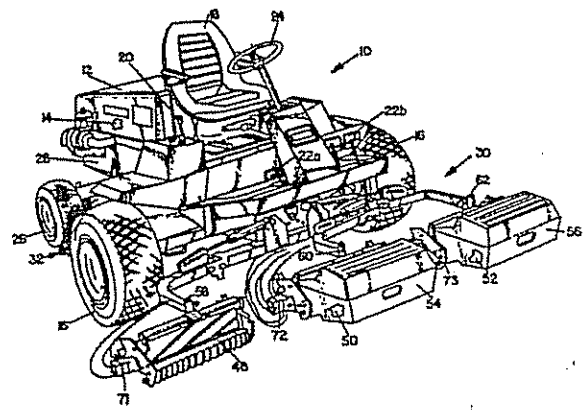
Primary Examiner—Terry Lee Melius

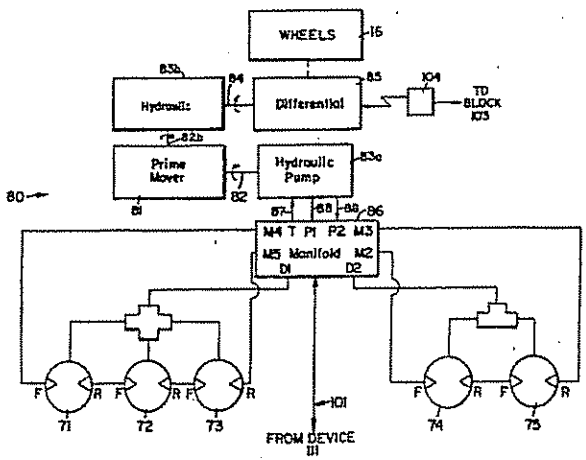
Attorney, Agent, or Firm—Merchant, Gould, Smith, Edell, Welter & Schmidt

[57] ABSTRACT

The present invention provides for an automated supervisor switch device for maintaining an acceptable ground speed during cutting operations for a turf mower. The present invention does not interfere with the ground speed of the vehicle during cutting or non-cutting operations. In a preferred embodiment, an onboard controller and its attendant memory are provided with a predetermined maximum mowing speed. Second, the controller monitors the ground speed of the mower. Third, when the controller determines that the cutting reels are operative and the ground speed is approaching the maximum mowing speed of the mower, then operator perceptible warning is actuated to alert the operator. Fourth, if the speed exceeds the predetermined maximum mowing speed, then the controller disables the reels from mowing. In the preferred embodiment, the controller disables the reels by shutting off the hydraulic fluid flow from the hydraulic motors which rotate the cutting reels. Fifth, the operator is forced to take certain corrective action to re-enable the cutting reels. In the preferred embodiment, the operator is forced to move the cutting reel engagement lever to its on position.

11 Claims, 5 Drawing Sheets





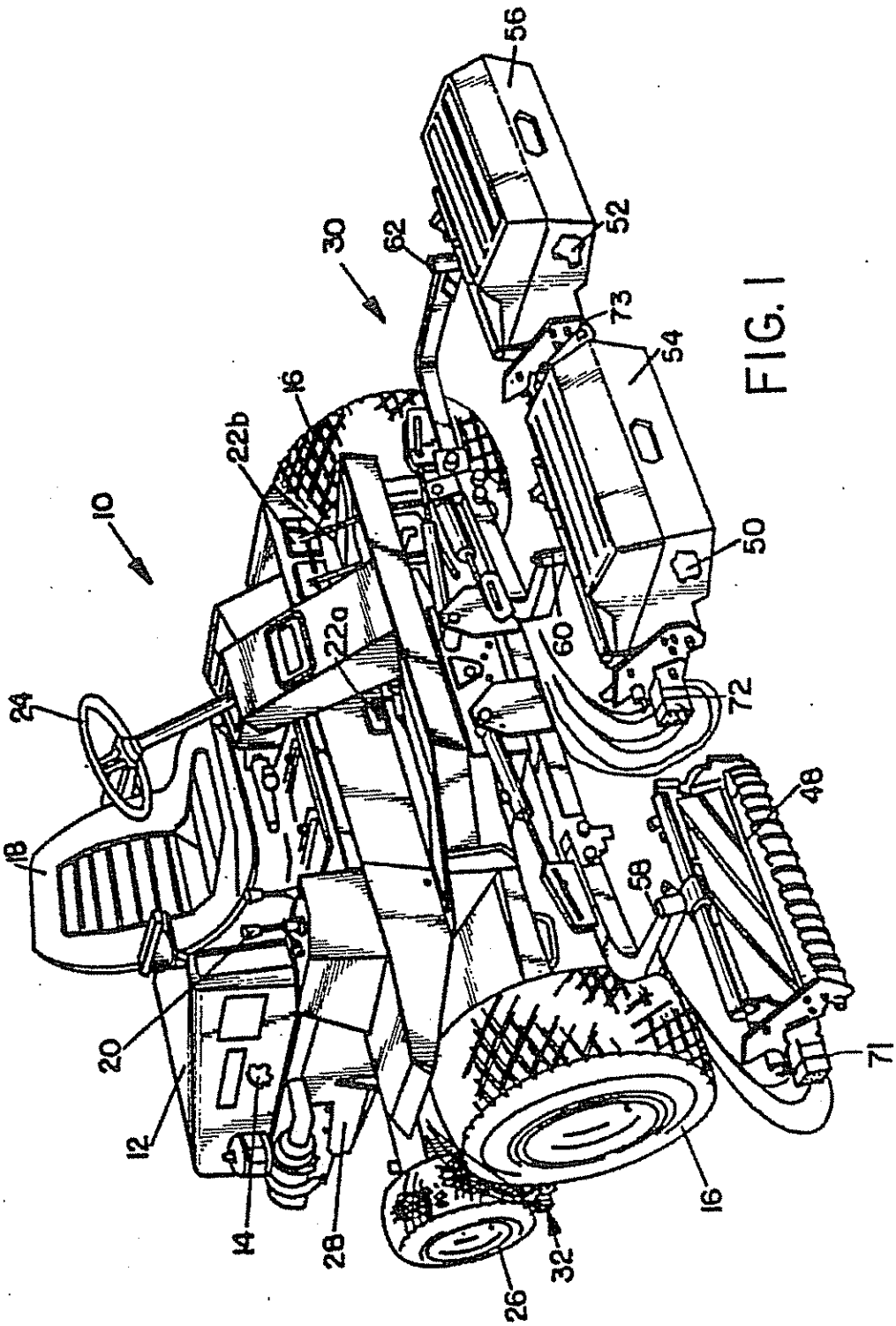
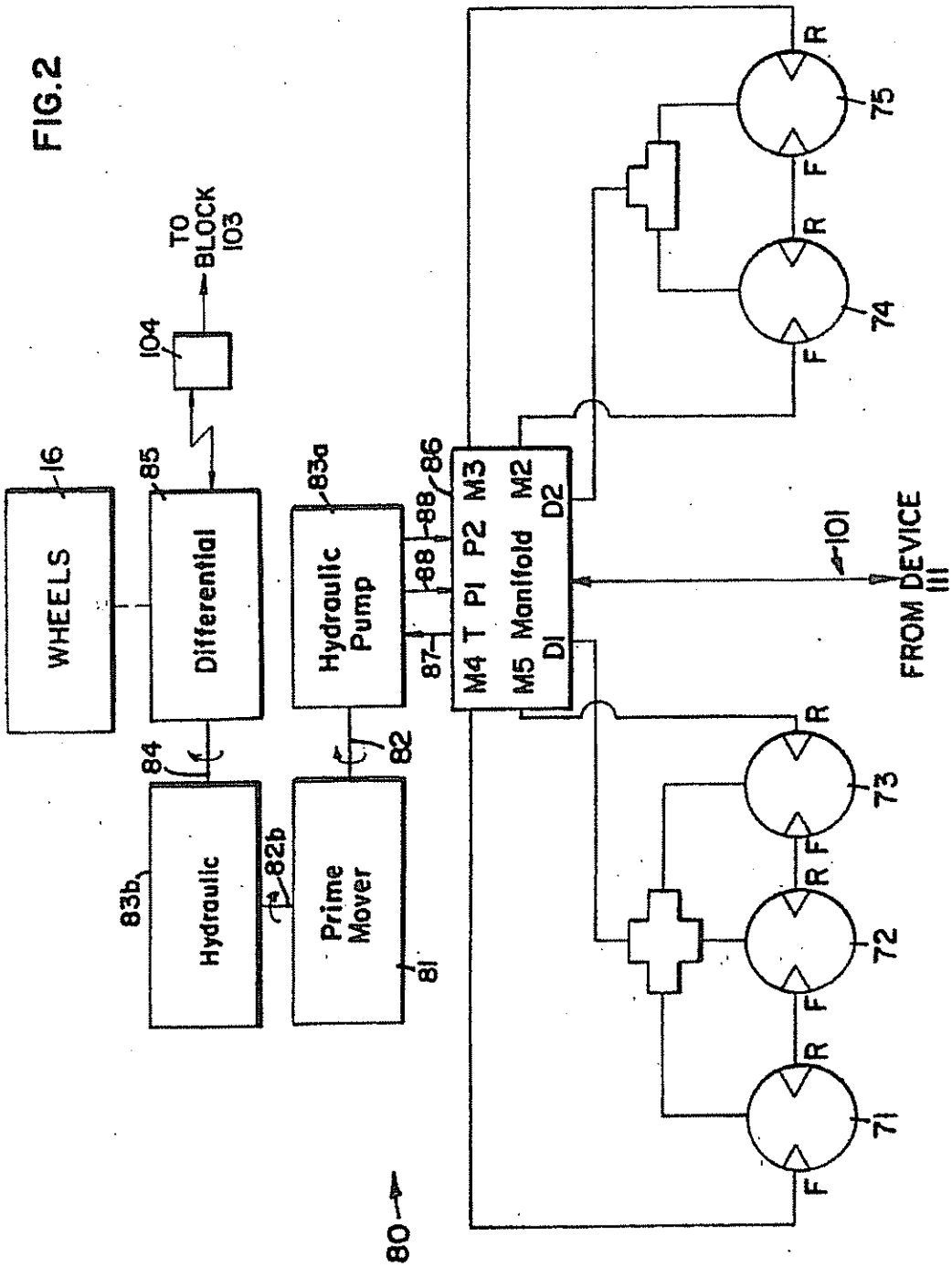

56
52
30
62
73
54
16
22b
10
50
22a
60
72
24
48
18
58
20
71
12
16
14
28
32
26

FIG. 1

FIG.2


WHEELS
16
Differential
85
TO BLOCK 103
104
Hydraulic Pump
83a
86
88
88
87
M4 T P1 P2 M3
M5 Manifold M2
D1 D2
101
FROM DEVICE 111
84
82
Hydraulic
83b
82b
Prime Mover
81
80
R
F
75
74
73
72
71

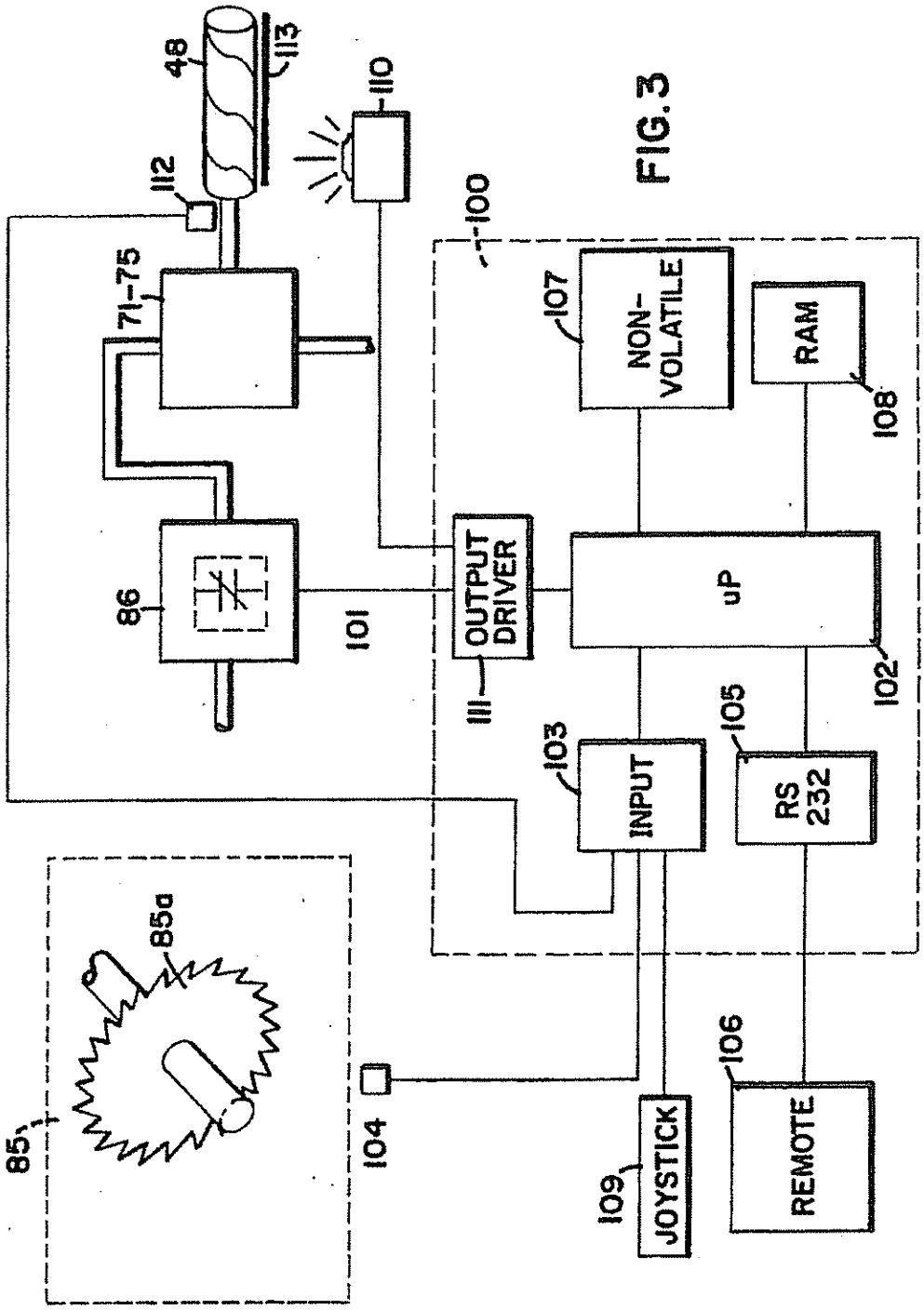
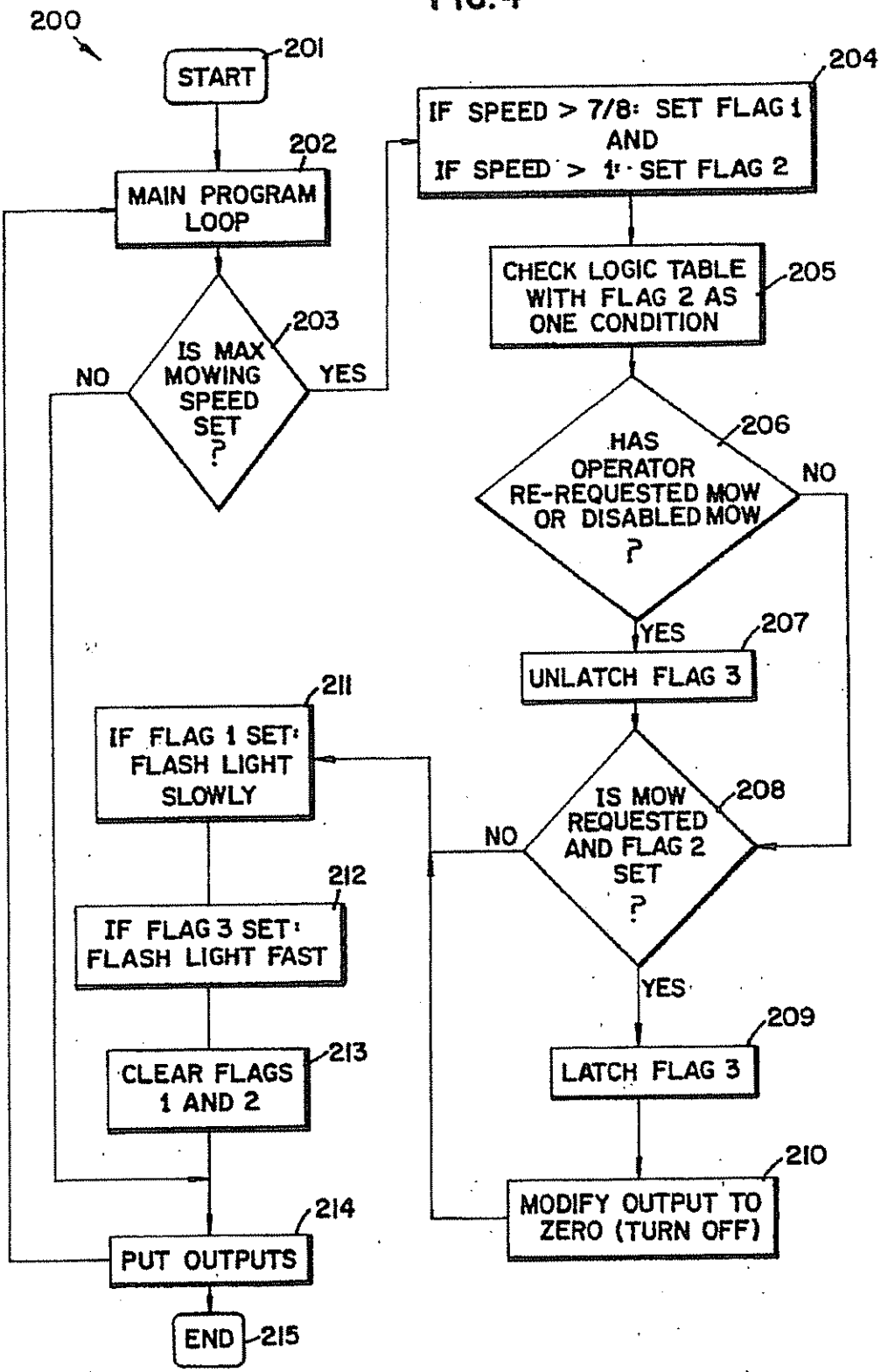

48
113
110
112
100
71-75
107
NON-VOLATILE
RAM
108
86
101
OUTPUT DRIVER
111
uP
102
103
INPUT
105
RS 232
85a
85
104
106
109
JOYSTICK
REMOTE

FIG. 3

FIG.4


200
START
201
MAIN PROGRAM LOOP
202
IS MAX MOWING SPEED SET ?
203
NO
YES
IF SPEED > 7/8: SET FLAG 1 AND IF SPEED > 1: SET FLAG 2
204
CHECK LOGIC TABLE WITH FLAG 2 AS ONE CONDITION
205
HAS OPERATOR RE-REQUESTED MOW OR DISABLED MOW ?
206
NO
YES
UNLATCH FLAG 3
207
IS MOW REQUESTED AND FLAG 2 SET ?
208
NO
YES
LATCH FLAG 3
209
MODIFY OUTPUT TO ZERO (TURN OFF)
210
IF FLAG 1 SET: FLASH LIGHT SLOWLY
211
IF FLAG 3 SET: FLASH LIGHT FAST
212
CLEAR FLAGS 1 AND 2
213
PUT OUTPUTS
214
END
215